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ABSTRACT

This paper critically reflects upon the questions asked and the models and methods employed to evaluate online learning in several studies. These online studies range from setting up online networks for social interaction and facilitating collaborative learning experiences among graduate students in several universities, to moderating worldwide online professional development activities. The paper examines the methodologies used to answer the following evaluation research questions: (1) How can we describe online participation, interaction patterns, and group dynamics? (2) Were students satisfied with their online learning experience? (3) Did participants learn? and (4) Was knowledge constructed? It is concluded that the adoption of a single technique for analyzing the quality of the learning experience in online learning networks has not yielded satisfactory answers, and a mixed methodology approach is recommended to study the complex nature of online learning networks. (Contains 11 references.) (MES)

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# EVALUATING ONLINE LEARNING: MODELS AND METHODS

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## Abstract:

This paper critically reflects upon the questions we have asked and the models and methods we have employed to evaluate online learning in several studies. The paper examines the methodologies used to answer the following evaluation research questions: 1. How can we describe online participation, interaction patterns, and group dynamics? 2. Were students satisfied with the experience of participating in the conference? 3. Did participants learn? 4. Was knowledge constructed?

One of the critical challenges facing educators as we move into the twenty-first century is the development of appropriate methodologies and tools for evaluating online learning networks. The open-ended nature of online learning projects, the multiple threads of conversation, and the fluid participation patterns pose new challenges to evaluators. Online learning designs are often based on constructivist, learner- centered principles which provide more learner control, facilitate the sharing of multiple perspectives, and places emphasis on individual learners creating their own meaning. Behavioral objectives with a stated outcome for all learners, is not the goal of many online learning projects. Traditional evaluation methods used to evaluate learning within the four walls of a classroom do not transfer well to the online context. Evaluators therefore, are challenged to understand the unique characteristics of the online medium and its social and ecological structure in order to develop new principles for evaluating learning.

The purpose of this paper is to critically reflect upon the questions we have asked and the models and methods we have employed to evaluate online learning in several studies we have conducted. These online studies range from setting up online networks for social

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interaction, facilitating collaborative learning experiences among graduate students in several universities, to moderating worldwide online professional development activities.

This paper will be organized according to the evaluation questions we have asked and attempted to answer:
1. How can we describe online participation, interaction patterns, and group dynamics?
2. Were students satisfied with the experience of participating in the conference? Did they feel that it had been a worthwhile use of their time, and one that they would be willing to repeat?
These questions were answered using a variety of techniques; both quantitative and qualitative. However, while these questions have value in understanding the nature of a computer conference (CC) , they do not yield useful information on the quality of the learning that took place.
One significant question which has yet to be satisfactorily answered is: How do you assess the quality of the learning experience in a computer-mediated conference (CMC)? Questions we need to ask are:
3. Did participants learn?
4. Was knowledge constructed?

Currently, the question that has intrigued us, is: How is knowledge constructed in online learning networks through the process of social negotiation? In order to address this challenging question, content analysis or interaction analysis of computer transcripts using qualitative research techniques is essential. We have relied on interaction analysis in our attempts to develop an interaction analysis model for examining social construction of knowledge in online learning networks (Gunawardena, Lowe, and Anderson, 1997) which we will describe in this paper.

## How Can We Describe Online Participation, Interaction Patterns, and Group Dynamics?

Participation analysis techniques examine the capacity of a conference to engage members and reveal comparative patterns of participation among learners from varying backgrounds. An evaluation tool we have employed to address these questions is the model developed by Levin, Kim and Riel (1990) for analyzing instructional interactions on electronic message networks. This model has four dimensions of analysis: 1) Participant Structures Analysis, 2) Intermessage Reference Analysis, 3) Message Act Analysis, and 4) Message Flow analysis. We used this model to evaluate a peer support network for medical students at the University of New Mexico (UNM), set up to maintain the social and psychological support network during the period of time that they worked with preceptors in isolated rural communities in New Mexico (Gunawardena, Gittinger, and Dvorak, 1991).

In reflecting on the use of the Levin, et al. (1990) model, we found that while it is a good starting point for obtaining an overall picture of the network group, activities, and interaction, it did not fit neatly with the purpose of our project. The Intermessage Reference Analysis was difficult to apply since our application of CMC was primarily

social in nature. All participants on-line were peers; no instructor activity existed. The purpose of these communications was not academic and tasks were not performed on-line. As a result, information such as whose messages were referenced most, what topics were referenced most, did not stand out in any particular way. Levin, et al. do not address content analysis within Message Act Analysis. We found our research was enriched by a careful analysis of the content of the interaction. We have found other data such as unsolicited participant reactions online, solicited participant reactions, both instructor and student perspectives on interaction and the analysis of computer transcripts to be more useful in forming a picture of events that occurred in the online community (Gunawardena, 1993).

Were Learners Satisfied with Their Online Learning Experiences?

The methods we have used most often to solicit learner reactions to and satisfaction with online learning experiences include online surveys, paper and pencil surveys, and participant reactions to the conference posted online in a conference area designed for this purpose. Another important source of data are the unsolicited comments on participant satisfaction or dissatisfaction with the learning experience that occur throughout the transcript.

Structured survey questions are useful in obtaining an overall view of student reactions to the conference and their satisfaction. It is also possible to obtain more in-depth data on selected open-ended questions. The survey is an easy vehicle to obtain data when students are scattered across geographic distance. Analysis of survey data has taken many forms depending on the questions we have asked related to various studies we have conducted.

Hiltz ( 1990) discussed an approach to determining learner satisfaction by examining the social psychological (characteristics of the users); human relations (characteristics of the groups and organizations within which systems are implemented); and technological determinist (characteristics of the system); factors that impact student satisfaction with, and subsequent use of computer conferencing. Using her theoretical framework we examined a computer conference in which a group of graduate students from the University of New Mexico joined 13 academic experts from 7 countries to discuss "cooperative learning" within the context of a global electronic pre-conference for the international TeleTeaching '93 conference held in Norway (Gunawardena and Heeren, 1993). The analysis was based on a questionnaire that addressed Hiltz's dimensions. One of the major problems associated with our study and with quantitative analysis when applied to the CMC context was sample size and sample selection. While multiple regression and analysis of variance were conducted to examine these variables, the statistical significant differences are not convincing because of the small number of participants in our study.

A recent quantitative study we conducted to answer the question: What are the variables that can predict student satisfaction in online learning networks? yielded more positive

outcomes (Gunawardena & Zittle, 1997). The purpose of this research was to examine which process variables such as proficiency in technical skills, learner support, and "social presence" or the degree to which a person is perceived as "real" in mediated communication (Short, Williams, and Christie, 1976), could predict learner satisfaction within a CMC environment. The process and satisfaction variables were measured by a 61-item questionnaire consisting of predominantly five-point Likert scale items specially designed for this study.

The subjects were fifty graduate students from five universities: San Diego State (N=8), Texas A & M (N=11), University of New Mexico (N=14), University of Wisconsin-Madison (N=7), and University of Wyoming (N=10), who participated in the Fall 1993 Globaled inter-university virtual conference. The Globaled conference was an academic exercise that was a class requirement at each participating university (Gunawardena, et. al. 1994).

In this analysis (Gunawardena and Zittle, 1997), eight process variables were used to predict overall satisfaction with the Globaled conference. The stepwise regression analysis converged on a three-predictor model revealing that social presence, student perception of having equal opportunity to participate in the conference, and proficiency in technical skills accounted for about 68% of the explained variance. Social presence alone contributed about 60% of this variance, suggesting that it may be a very strong predictor of satisfaction. Although care must be taken in generalizing these results due to sample selection and size, the results suggest that social presence alone is a strong predictor of satisfaction in a text-based computer conference.

When reflecting on the quantitative analyses we have done using surveys, we feel that the strengths of these analyses lie their ability to point out salient differences in process variables as they relate to learner satisfaction. One of the shortcomings of quantitative analysis however, is the inability to explain the reasons for the significant differences observed. This is where qualitative analysis of open-ended questions or interviews is of value. A related problem with quantitative analysis when applied to the CMC context, is the small sample size in many conferences, and problems related to sample selection as random sampling is difficult in the distance education context. Quantitative analyses should be performed only when there is an adequate sample size to study the variables of interest. Qualitative data used in conjunction with quantitative data can usually explain the significant differences found. Therefore, we would advocate a mixed methodology approach (Tashakkori & Teddlie, 1998) combining quantitative and qualitative data to overcome some of the problems related to quantitative data alone.

Did participants learn?

How did the individual learner make sense of the computer conference? What did he or she learn? These questions are more difficult to answer if we subscribe to a constructivist view of learning where the individual learner is expected to take away a unique perspective from the learning experience. Traditional methods of measuring learning

using pre and post tests will not work well in this context as learning occurs in many different forms and is not limited to learning the content or subject under study. We have been interested in examining questions related to learning from two perspectives: What did participants learn about the subject/topic/content that was discussed? and What did they learn about the medium of computer conferencing and it's influence on the learning process?

One method is to analyze the computer transcript as it affords an unobtrusive, and fairly accurate means of gauging whether participants learned during the conference. If one looks carefully at the transcript, we can decipher several unsolicited comments or "thinking aloud" comments that refer to individual learning such as the following in a debate that discussed the importance of 'interaction' to distance education: "In the past two days, you who are participating in this conversation have made me stop and think about 'interaction.' I guess you'd call that 'learning.' Without your thoughts this would not have happened. I think this demonstrates the importance of 'interaction' to learning." (Gunawardena, Lowe, and Anderson, 1995, p. 202).

Another technique is to ask participants directly what they learned, either through open-ended questions in questionnaires, or individual interviews, or, asking them to discuss their learning in a separate conference space specially designed for this purpose. In a study where we used open-ended questions in a questionnaire to find out what students learned about "cooperative learning," the topic of the conference, we found that students learned about: 1. cooperative learning as an educational concept, 2. how to participate in a conference that generated diverse opinions, 3. what makes a good and a bad conference, and 4. how to use the technology to participate in a computer conference (Gunawardena and Heeren, 1993).

Evaluation data on student learning can also be collected online by asking very general questions such as: What did you think about this computer conferencing experience?

In order to understand the myriad forms of learning that occurs in a computer conference, we have often asked students to keep weekly journals documenting all aspects of learning. These journals have given us a unique perspective of each individual's learning process. Other techniques we have used are to ask students to critique their online learning experiences and to apply and transfer what they have learned from the computer conference to developing a computer conferencing design.

In reflecting on the various evaluation techniques we have used to understand student learning, we have found that qualitative approaches work better than quantitative methods in being able to understand the unique ways in which individual students learn.

## Was Knowledge Constructed?

Perhaps the most challenging and the most exciting question one can ask in evaluating online learning is: Was knowledge constructed within the group by means of the

exchanges among participants? We will discuss two interaction analysis models we have used to answer this question. Initially, we began to use Henri's (1992) model to analyze the transcripts of a global online debate we had conducted as an adult professional development experience. However, it became clear that three aspects of Henri's model; its basis in a teacher-centered instructional paradigm, its distinction between the cognitive and the metacognitive dimensions, and its treatment of the concept of interaction, were unsuited for application to the debate. We felt that we needed to develop a new definition of interaction for the CMC context if we are to examine the process of social negotiation (Gunawardena, Lowe, and Anderson, 1997).

We believe that the metaphor of a patchwork quilt better describes the process of shared construction of knowledge that occurs in a constructivist learning environment. A quilt block is built up by the application, one after another, of small pieces of cloth, which when assembled form a bright and colorful pattern. The pieces, according to this analogy, are the contributions of individual participants. Each participant contributes to the whole his or her own texture and color of thought, just as every scrap of fabric forms a distinctive element in the overall pattern. The pattern may not be complete during a single conference, but individual responses can contribute toward the formation of a pattern. The process by which the contributions are fitted together is interaction, broadly understood, and the pattern which emerges at the end, when the entire gestalt of accumulated interaction is viewed, is the newly-created knowledge or meaning. Interaction is the essential process of putting together the pieces in the co-creation of knowledge.

Based on this new definition of interaction, and grounded theory principles, we developed an outline of the process of negotiation which appears to occur in the co-construction of knowledge. The outline led to the development of the interaction analysis model which has five phases, reflecting the complete process of negotiation which must occur when there are substantial areas of inconsistency or disagreement to be resolved. The phases of learning outlined in this model occur at both the individual and social level and can be described as:
Phase I: Sharing/Comparing,
Phase II: Dissonance,
Phase III: Negotiation/Co-construction,
Phase IV: Testing Tentative Constructions, and
Phase V: Statement/Application of Newly-Constructed Knowledge.
A detailed discussion of this model and its underlying theoretical framework is found in Gunawardena, Lowe, and Anderson (1997).

Two major themes were observed related to knowledge construction. One was the progress of certain strands of argument from Phase I to Phase V which can be described as an exercise in the co-construction of knowledge, moving from lower to higher mental functions. The other was the evidence of more than one and sometimes three phases within a single message posted by one participant, which usually progressed in sequence through the phases, showing progress from lower to higher mental functions, showing how individuals contributed toward the co-construction.

## Conclusion

The adoption of a single technique for analyzing the quality of the learning experience in online learning networks has not yielded satisfactory answers. The complex nature of online learning calls for the use of multiple methods and multiple sources of data to understand group as well as individual learning. While quantitative analysis of interaction patterns and learner satisfaction has yielded useful information on the overall nature of online learning and the variables that influence its success, several problems exist in the application of the quantitative paradigm to evaluating learning in the online context. Two problems relate to sample size and selection. While quantitative data can point out a significant difference, it cannot adequately explain the reasons for the observed difference. The naturalistic paradigm employing qualitative data from in-depth interviews, observations, and computer transcript analysis, can often explain the observed differences. When used in conjunction with quantitative data, qualitative data can overcome some of the shortcomings of utilizing quantitative data alone. Therefore, it is recommended that a mixed methodology approach be used to study the complex nature of online learning networks.

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